Transportability of Regional Phase Spectral Ratio Discriminants

T. J. Bennett and J. R. Murphy
S-CUBED
11800 Sunrise Valley Dr., Suite 1212
Reston, Virginia 22091
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Abstract

This research program is intended to provide a thorough assessment of the transportability of regional phase spectral ratios as discriminants between underground nuclear explosions and other source types. Although L_g spectral ratios appeared to offer considerable promise for distinguishing between nuclear explosions and nearby earthquakes based on experience from the vicinity of the Nevada Test Site, attempts to extend this spectral ratio discriminant into other geographic regions (e.g. the vicinity of the Semipalatinsk/Balapan test site) have not always proven to be successful. One of the main obstacles to demonstrating the value of regional phase spectral ratios as discriminants has been difficulty in finding events of different source types with similar magnitudes and like propagation paths to enable direct comparisons of spectral ratio measurements. In addition, attempts to provide theoretical bases for understanding differences in regional phase signals from different source types have proven to be of only limited success.

The principal objectives of this research program are to develop more complete understanding of the influences of source excitation and propagation on the transportability of regional phase spectral ratio discriminants and to define criteria for application of spectral ratio discrimination methods in uncalibrated areas. For these studies we are looking at spectral ratios for all types of regional phases including P_n, P_g, and S_n in addition to L_g. We are performing a thorough empirical analysis of available regional data from different event types in distinct source environments. Signal spectra for the different phases are to be adjusted for influences of attenuation and source size using empirical models developed from information on regional propagation characteristics and source excitation appropriate to the specific tectonic regions. The empirical models used for these corrections will be tested for selected cases using theoretical modeling techniques. We anticipate that by applying appropriate corrections we will be able to more reliably discern source-dependent differences in the regional phase spectral ratios and define characteristics which are transportable into different, uncalibrated monitoring environments.

Key Words: Seismic, Discrimination, Regional, Calibration, Explosion, Earthquake.